

## STANDARD TRAY CARRIER FOR ALIGNING TRAYS

### BACKGROUND OF THE INVENTION

#### RELATED APPLICATIONS

This application is related to U.S. Application entitled "Self Aligning Tray and Carrier Apparatus" filed on the same date as this application, bearing attorney reference 067810/0303262, which is expressly incorporated by reference herein.

#### FIELD OF THE INVENTION

[0001] This invention relates to trays for use in carrying semiconductor devices, and more particularly to a tray carrier configured to align and carry a plurality of identical trays so as to maintain the distance between component pocket locations at integer multiples of the pocket center to center spacing within the trays.

#### DESCRIPTION OF THE RELATED ART

[0002] Components, such as semiconductor devices, integrated circuits (ICs) or other devices are typically conveyed in component pockets in component trays prior to being installed in a final product. ICs may be placed in and removed from a component tray by means of automated IC handling equipment. Calibration of such equipment requires knowledge of the dimensions of the component tray and relative positions of the component pockets in the component tray. In order to aid in the design and use of this automated equipment, standard component tray sizes have been established for some applications. One such set of standards is the Joint Electron Device Engineering Council (JEDEC) standards, which set component tray outline dimensions.

[0003] A commonly used JEDEC standard component tray for example, has overall dimensions of 322.6 mm by 135.9 mm by 7.62 mm. This large size component tray could contain a large quantity of component pockets. It is common for semiconductor device manufacturers to use smaller component trays, which may then be in conflict with a JEDEC standard component tray to which an automated handling machine is calibrated. For example, Fig. 1 shows a 2" x 2" component tray. In order to accommodate the smaller component tray sizes and at the same time accommodate

a JEDEC standard, U.S. Patent Serial No. 6,082,547 by Nentl et al. discloses a “jig” tray with external, overall dimensions of a JEDEC standard, with three compartments for enclosing three smaller component trays. Spring apparatus is used to force the smaller component trays into known positions in the X-Y plane relative to the jig tray outline. This design has the disadvantage of not providing for secure vertical (Z-direction) captivation, and does not address inter- component tray dimensioning.

### SUMMARY OF THE INVENTION

[0004] It is an advantage of this invention to provide a carrier tray with facility for holding a plurality of component trays having an improved component pocket alignment.

[0005] It is another advantage of the present invention to provide a carrier tray that securely retains a plurality of component trays in three dimensions.

[0006] The above advantages, among others, can be achieved singly or in combination. In one embodiment of the present invention a carrier tray is configured with a channel structure, providing a channel for holding a plurality of component trays in a single row, with substantially no spacing between the component trays. The component trays ride on a bottom support of the channel, which can, for example, be a flat plane, or two or more bottom rails. A first side rail on one side of the channel and a second side rail on an opposite side, or tabs on opposite sides of the channel extend over corresponding first and second opposing edges of the component trays, and are provided for the purpose of preventing movement of the component trays in an upward vertical direction. The channel structure also includes first and second side containment walls on first and second opposing sides of the channel for securing the component trays laterally in the channel. The carrier tray has an end stop at a distal end of the channel for restricting movement of the row of component trays. The component trays are inserted in the channel by sliding each component tray in at a proximal end of the channel. A resilient retainer apparatus installed at the proximal end urges the component trays together.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The above and other features and advantages of the present invention are further described in the detailed description which follows, with reference to the drawings by way of non-

limiting exemplary embodiments of the present invention, wherein like reference numerals represent similar parts of the present invention throughout several views and wherein:

[0008] Fig. 1 illustrates a 2" x 2" component tray;

[0009] Fig. 2 is a perspective view of a carrier tray of the present invention;

[00010] Fig. 3 illustrates a carrier tray and component tray combination according to the present invention; and

[00011] Fig. 4 is an enlarged sectional view for description of the operation of apparatus for horizontally urging and vertically restraining the last component tray according to one embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00012] While the present invention will be described herein with reference to particular embodiments thereof, a latitude of modifications, various changes and substitutions are intended, and it will be appreciated that in some instances some features of the invention will be employed without a corresponding use of other features without departing from the spirit and scope of the invention as described with respect to the preferred embodiments set forth herein.

[00013] Referring now to Fig. 2, one embodiment of the present invention includes a carrier tray 10 having dimensions L, W and D, any one or more of which may in an alternate embodiment conform to a JEDEC standard. Within the dimensions L, W and D, the carrier tray 10 includes a component tray captivating channel 12 for holding a plurality of component trays such as the component tray of Fig. 1. For example, the carrier tray 10 of Fig. 2 is configured for captivately holding 5 component trays. The carrier tray 10 component tray captivating channel 12 includes a top opening 14 for access to pockets 16 (Fig. 1) in each of the component trays held by the carrier tray 10. For example, Fig. 1 shows a component tray with 16 pockets, each indicated as item number 16.

[00014] The bottoms of the component trays are supported by component tray support apparatus 18, which as shown in Fig. 2 is simply a flat, planar surface, but which could be any structure capable of supporting the component trays in the channel 12. Downward movement of the component trays is restrained by the bottom support apparatus 18. Upward movement of the component trays is restricted by upward vertical restraining apparatus 24, illustrated in the embodiment of Fig. 2 as eight side tabs 26, one end tab 28, and tabs 30 on retainer clip 32. The eight

tabs 26 are positioned so as to be located over the intersections of adjacent abutting component trays installed in the channel 12. Fig. 3 shows five component trays 34-42 serially positioned relative to one another in the channel 12, with the eight tabs 26 over the component tray edges, centered over the abutting junctions 44-50 between the component trays 34-42. Component tray 34 is the first component tray inserted in the channel 12, then component tray 36, etc. to the last component tray 42 inserted. Component tray 34 is restrained from vertical movement at a distal end 52 of the channel 12 by tab 28. The last component tray 42 inserted is retained vertically at the proximal end 54 of the channel 12 by tabs 30 of the retainer clip 32. The carrier tray 10 includes longitudinal component tray restraining apparatus along the direction of the length of the channel 12 relative to the carrier tray 10. The longitudinal restraining apparatus is for forcing the component trays into abutting contact as shown in Fig. 3. The longitudinal restraining apparatus restricts movement in the longitudinal direction 56 of the channel 12, and includes an end stop apparatus at the distal end 52, illustrated as the wall 58 in Figs. 2 and 3. The end stop could also be a post or other object, which will be understood by those skilled in the art. The longitudinal restraining apparatus further restricts movement of the trays with a horizontal urging apparatus 60 at the proximal end 54 of the channel 12, illustrated as part of the clip 32 which being resilient provides compressive force for pushing on the component tray 42 in the direction of the channel towards the distal end 52, causing each of the component trays 34-42 to touch an adjacent component tray. Other apparatus for urging the component trays 34-42 together in the channel are also included in the present invention. For example, a separate coil spring actuated pin could supply the pressure required, or a screw could be used to push the component tray 42 in the direction 56, etc.

[00015] The clip 32, being resilient, also provides a compressive force for holding the proximal end of the tray 42 in contact with the bottom support apparatus 18. This is accomplished by contract of the tabs 30 with the top edge 62 of component tray 42. The resilient compression force is achieved by gripping resilient legs 70 and 71 with tensioned restraining clips 80 and 81 as shown in Fig. 4, which will be further described in reference to Fig. 4 in the following text of the specification.

Fig. 4 is a section A from Fig. 3 showing more clearly the clip 32 and related apparatus working in combination with the clip 32 for providing the downward retainment of the last component tray 42, and for urging the component trays together. Referring to both Fig. 4 and Fig. 3, the clip 32 horizontal and vertical urging apparatus includes flexible and resilient legs 70 and 71

with leg tabs 72 and 73 at the leg ends. The tabs 72 and 73 are inserted in openings 74 and 75 in walls 76 and 77. The openings 74 and 75 serve the necessary function of restricting motion of the tabs 72 and 73 in the backward and downward directions. With the tabs 72 and 73 in the openings 74 and 75 and the clip installed as shown, the front rail 79 of the clip is forced into contact with the end wall 78 of the tray 42. In order to do this, the clip 32 is dimensioned so that the legs 70 and 71 bend upon installation, and thereby provide a spring tension to the wall 78, urging the component tray 42 down the channel 12 and causing all of the component trays 34-42 into contact with each other as described above. With the clip 32 in position as shown in Fig. 4, each of the vertical restraining clips 80 and 81 is raised upward and snapped over the corresponding legs 70 and 71. The clips 80 are flexible and resilient and therefore when clipped over the legs 70 and 71, they apply a downward force on the legs 70 and 71, and therefore cause a downward force on the tabs 30 for holding the component tray 42 in contact with the bottom support apparatus 18.

Fig. 3 shows five component trays installed according to the present invention in the carrier tray 10. Another embodiment of the present invention includes the combination of component trays such as 34-42 and the carrier tray 10, with the trays configured so that the distance "d1," between the centers of the pockets of adjacent trays is an even multiple of the distance "d2" between pockets within each tray. This configuration of even spacing between the pockets in the row of component trays in the channel allows for easy calibration of automated equipment designed for accessing the pockets 82.

Referring again to Fig. 2 of the drawing, as an alternate embodiment, the planar surface 18 could be replaced with two or more rails running the length of the channel 12, or a grid structure, etc. The channel includes a first side tray restraining apparatus 20 and a second side tray restraining apparatus 22, shown as vertical walls, but various other structures will be apparent to those skilled in the art for restraining the component tray, and these structures are to be included in the spirit of the present invention. For example, a series of vertical posts, or a horizontal rail could be used for the purpose of restraining the component trays laterally in the channel 12. In addition, the component tray restraining apparatus described above is given as an example. The present invention also includes other apparatus for the purpose. For example, in reference to Fig. 3 an elongated first side rail on one side of the channel 12 and an elongated second side rail on an opposite side of the channel 12 could be used to restrain the trays in the upward direction away from the component tray

support apparatus 18. This is illustrated by dashed lines 66 and 68 in Fig. 2 that in effect illustrate elongation of the tabs 26 so as to make one long tab/rail on each side of the channel 12.

Using the long rails 66 and 68 as shown in Fig. 2 provides complete captivation in the upward vertical direction, and tab 28 and tabs 30 are therefore not needed for upward vertical restraint of the component trays. However, if the rails 66 and 68 are extended too far toward the proximal end, the rails 66 and 68 at 70 and 72 for example could invade a space conveniently used for insertion of the component trays in the channel. The configuration of the clip 32 or other urging apparatus, and the position of the end of the rails at 70 and 72 in an alternate embodiment using elongated rails is designed to allow space for inserting the component trays in the channel at the proximal end. In this case, the clip 32 or other spring apparatus need only supply longitudinal pressure on component tray 42.

As mentioned above, the present invention includes the various methods of applying a downward pressure for captivation of the edge 62 of the last component tray 42, as well as various methods of urging the component trays together.

While the present invention has been described herein with reference to particular embodiments thereof, a latitude of modifications, various changes and substitutions are intended in the foregoing disclosure, and it will be appreciated that in some instances some features of the invention will be employed without a corresponding use of other features without departing from the spirit and scope of the invention as set forth in the appended claims.